HOSPITAL AND TRAINING SCHOOL ADMINISTRATION

IN CHARGE OF

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From time to time there are inquiries from the busy or isolated superintendent as to how instruction shall be given in such and such instances regarding computations of doses and the making of solutions. It would be better if the pupil's mathematical sense were strong enough to enable her to compute without rules, but, alas, the time when a little daily practice in mental arithmetic was a form of school room recreation has gone very far by, so that a great many young people, otherwise well equipped, are aghast when confronted by a little problem such as those given below. They are thrown into this state of mind, not only by a knowledge of their deficiencies, but they also know that a mistake, innocent elsewhere, might bring disaster to their patients. It is in response to such inquiries that the following illustrations are presented.

It would be well if a better understanding of the metric system were insisted upon, because being in the form of decimal fractions it is more workable for the average nurse. Some years ago the writer picked up (probably from Groff's "Materia Medica") the following table which has been her "handy reference" ever since. It is so little it can easily be learned:

500 cc. = 1 pt.	4 cc. = 1 fl. dr.
500 gm. = 1 lb. avoirdupois.	4 gm. = 1 dr.
30 cc. = 1 fl. oz.	1 cc. = xv ♏
30 gm. = 1 oz.	1 gm. = xv gr.
.065 gm. = 1 gr.	

Of course there is vastly more to the metric system than is here outlined, but most of our purposes can be accomplished with this little table. Many schools are making drills of this kind a part of the preliminary course, which is certainly wise. Let the pupil be made to understand percentage, but if her knowledge of that subject in common arithmetic is limited she will do better to thoroughly understand simply the meaning of the term per cent., for then she will not venture beyond her depth.

There are some good books on materia medica for nurses,—prepared by nurses and others,—which can be obtained of any bookseller dealing in scientific books.

If nurses would remember the simple statement that practically or approximately $7\frac{1}{2}$ grains of a drug to the pint are required to make a solution of 1:1000 they might save themselves some computation. It can be proved or worked out and found to be absolutely correct according to the metric system, but only approximately so according to the system we commonly use. Let us see that there is a little difference according to the two systems.

Metric System.

1 : 1000 = $\frac{1}{1000}$ and each ♏ contains $\frac{1}{1000}$ gr.
15 ♏ (1 cc.) contains $\frac{15}{1000}$ gr.
1 pint or 500 cc. contains $\frac{7500}{1000}$ gr. or $7\frac{1}{2}$ gr.

Apothecaries' Fluid Measure.

1 : 1000 = $\frac{1}{1000}$ and each ♏ contains $\frac{1}{1000}$ gr.
fl. dr. 1 contains $\frac{60}{1000}$ gr. or $\frac{3}{50}$ gr.
fl. oz. 1 contains $\frac{24}{50}$ gr.
pint 1 contains $16 \times \frac{24}{50}$ gr. = $\frac{192}{25}$ gr. or $7\frac{17}{25}$ gr. approximately $7\frac{1}{2}$ gr.

Unless the class is able and has time to work this out, perhaps it is as well to tell them to paste the fact up in their memories and let it go at that. It is a fact they will need to use often and upon short notice, so they must remember it. Some one may wisely ask why we talk about $7\frac{1}{2}$ grains to the pint when it would be so much easier to consider 15 grains to the quart. To this we may reply true, but we are in the habit of seeing the bichloride of mercury tablet of commerce stamped $7\frac{1}{2}$ gr. with the instruction to use one to each pint of water for a 1:1000 solution; therefore to avoid confusion we adhere to the mixed number.

Suppose an order called for a quart of bichloride solution 1:3000—how much of the drug shall be used and how shall it be obtained?

Starting with the fact that $7\frac{1}{2}$ grains are required for a pint of 1:1000 solution, to make 1:3000 we naturally take $\frac{1}{3}$ as much because 1:3000 is $\frac{1}{3}$ as strong as 1:1000.

$\frac{1}{3}$ of $7\frac{1}{2}$ or $\frac{15}{2}$ is $\frac{5}{2}$ gr.;

but this makes one pint and to make two pints or a quart we must use twice $\frac{5}{2}$ gr. or 5 gr.

But how shall we get it out of our $7\frac{1}{2}$ gr.? To get 5 gr. we must take such a part of $7\frac{1}{2}$ gr. as $7\frac{1}{2}$ gr. is contained in 5 or

$$\frac{5}{1} \div \frac{15}{2} = \frac{5}{1} \times \frac{2}{15} = \frac{10}{15} = \frac{2}{3}$$

We must take $\frac{2}{3}$ of $7\frac{1}{2}$ gr. How?

Our easiest way is to dissolve $7\frac{1}{2}$ gr. in a little water and take $\frac{2}{3}$ of the solution thus made. After which, if we add sufficient water to make a quart, we shall have what we wished to obtain.

This same process holds when computing per cent. strengths; for instance, let us suppose the order to call for $\frac{1}{2}$ fl. oz. of a 4 per cent. solution of cocaine. Four per cent. is $\frac{4}{100}$ or $\frac{1}{25}$, which is the same as 1:25. From here we may go on as above, using either the metric system or apothecaries' fluid measure, as we choose.

Again, a nurse is asked to give strychnia gr. $\frac{1}{150}$. She has only tablets that are $\frac{1}{60}$ gr. each. How shall she proceed?

Following our method in the above illustration we say she should give such a part of a tablet as $\frac{1}{150}$ is of $\frac{1}{60}$. $\frac{1}{150}$ is such a part of $\frac{1}{60}$ as $\frac{1}{60}$ is contained times in $\frac{1}{150}$ or $\frac{1}{150} \div \frac{1}{60} = \frac{1}{150} \times \frac{60}{1} = \frac{2}{5}$. Therefore to get $\frac{1}{150}$ gr. out of a tablet which is $\frac{1}{60}$ gr. we must take $\frac{2}{5}$ of it. Our easiest way of doing it is to dissolve $\frac{1}{60}$ gr. in water, say ♏ xxv and get $\frac{2}{5}$ of this, which is ♏ x. Doubtless we shall wish to teach our class habits of economy and we shall say further, now please do not waste any, and you need not if this order is to be repeated several times. You have, as you see, a dose and a half remaining, so you can readily understand that you might double the drug, use two tablets and double the amount of water and have sufficient for five doses with nothing to waste, since each dose is ten minims.

From these illustrations we may deduce the following rule and perhaps this may be pasted up beside the facts before mentioned.

Divide the amount to be given by the amount on hand. The result will tell you what part of the amount on hand you should take.

It may seem more difficult to reverse the above illustration and give $\frac{1}{60}$ gr. when we have tablets of only $\frac{1}{150}$ gr., but the principle is the same. Using our rule, we divide the amount to be given, $\frac{1}{60}$ by the amount on hand, $\frac{1}{150}$ and we have

$$\frac{1}{60} \div \frac{1}{150} = \frac{1}{60} \times \frac{150}{1} = \frac{5}{2} \text{ or } 2\frac{1}{2}.$$

We must therefore give $2\frac{1}{2}$ parts of the amount on hand, which in this case is $2\frac{1}{2}$ of the tablets that are each $\frac{1}{150}$ gr.

Again, how shall we prepare and give hypodermically atropine gr. $\frac{1}{200}$ from tablets that are each gr. $\frac{1}{150}$?

Follow the rule,—divide the amount to be given, $\frac{1}{200}$, by the amount on hand, $\frac{1}{150} = \frac{1}{200} \times \frac{150}{1} = \frac{150}{200} = \frac{3}{4}$, therefore we must give $\frac{3}{4}$ of a tablet.

Dissolve a tablet, $\frac{1}{150}$ gr., in twenty minims of water and give $\frac{3}{4}$ of it, or 15 minims of it hypodermically.

Another thing to remember is that 5 gr. to the ounce makes a 1 per cent. solution.

Let us illustrate. Any drug of 1 per cent. solution means that each minim contains $\frac{1}{100}$ gr. of the drug, each dram $\frac{60}{100}$ or $\frac{3}{5}$ gr. each ounce $\frac{24}{5}$ or $4\frac{4}{5}$ gr. or as a pharmacist would say 5 grains.

It would seem that having these few principles learned and remembered one could quite easily work one's way out of almost any difficulty in preparing solutions, doses, etc.

If a nurse is so unsure as to give two tablets of $\frac{1}{25}$ gr. each when her patient is ordered $\frac{1}{50}$ gr., or, having a 4 per cent. solution and wishing to make a 2 per cent. solution she does so by using double the amount, she is hopeless and ought not to be entrusted with such matters.

Such occasions prove to training-school superintendents the necessity of requiring the pupils to be educated, intelligent young women.

THE best part of health is fine disposition. It is more essential than talent, even in the works of talent. Nothing will supply the want of sunshine to peaches, and, to make knowledge valuable, you must have the cheerfulness of wisdom.—RALPH WALDO EMERSON.